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Rheological Behavior of Linseed *(Linum usitatissimum)* oil

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ABSTRACT

Linseed *(Linum usitatissimum)* oil has been utilized for thousands of a long time in human sustenance. Linseed oil could be a common item which is gotten by cold squeezing the seeds of the flax plant. Linseed oil contains critical vitamins and minerals, such as zinc, press vitamin E, the complex of B vitamins, magnesium, calcium, carotene, potassium and chromium. In this article we examined linseed oil at diverse temperatures and shear speeds. Applying a first order exponential condition to the tentatively gotten bends we gotten values of the relationship coefficients near to solidarity.

Keywords: Rheological, Lineseed, Oil, Temperature, Shear speeds, Dynamic viscosity.

INTRODUCTION

Rheology is the study of the flow and deformation of materials, which is particularly relevant for understanding the properties of complex fluids, including oils like linseed oil. Linseed oil, derived from the seeds of the flax plant *(Linum usitatissimum)*, is known for its drying properties, nutritional benefits, and use in various applications such as paints, varnishes, and food products.

Linseed oil's viscosity can change with temperature, shear rate, and time. It typically exhibits non-Newtonian behavior, meaning its viscosity may decrease (shear-thinning) or increase (shear-thickening) depending on the conditions.

Some formulations of linseed oil may exhibit thixotropic behavior, where the viscosity decreases under shear stress and gradually recovers when the stress is removed. This property is important for applications like paints and coatings, where a good balance between easy application and stability after application is desired.

The viscosity of linseed oil decreases with increasing temperature, which is common for most oils. Understanding this behavior is crucial for processing and application, especially in formulations that are temperature-sensitive.

The rheological properties of linseed oil can be altered by adding various additives such as thickeners, stabilizers, and other oils. These

modifications can enhance the oil's performance in specific applications.

Knowledge of the rheological properties helps formulators design paints that apply smoothly and dry to a desirable finish.

Understanding the flow behavior of linseed oil can improve its use in food products, ensuring proper mixing and stability.

Linseed oil is also used in cosmetics; rheology helps in formulating products that spread well and have the right consistency[1-3].

Linseed *(Linum usitatissimum)* oil has been used for thousands of years in human nutrition. In this article, we explain what are the substances that this plant contains, what are the benefits that medical studies have highlighted and what you should pay attention to when consuming linseed oil.

Linseed oil is a natural product, which is obtained by cold pressing the seeds of the flax plant. Linseed oil contains important vitamins and minerals:

- **Zinc:** it is an antioxidant and supports the immune system.
- **Iron:** helps to store oxygen in the cells.
- **Vitamin E:** it has antioxidant properties, which means it can help protect the body from the effects of free radicals. In addition, it helps the normal functioning of the immune system.
- **Vitamin B complex:** vitamin B is very important for the optimal functioning of the nervous system, the digestive system, the liver.
- **Magnesium:** magnesium supports the muscular and nervous system and stimulates the immune system. It is also known about this mineral that it plays an important role in the formation of bones and also helps the optimal functioning of the heart.
- **Calcium:** calcium is another important mineral that helps in the formation of bones and helps in the correct functioning of the metabolism.
- **Carotene:** it is a good antioxidant.
- **Potassium:** potassium is essential for the body and supports the correct functioning of the brain, heart, muscles and kidneys.
- **Chromium:** regulates the level of blood sugar and in addition improves blood circulation.

Studies are still being done, but from what is known so far, we have reason to believe that linseed oil has the following benefits[3]:

- **Maintains bone health:** this may also mean that it reduces the risk of osteoporosis and may also contribute to bone regeneration.
- **Reduces the risk of heart diseases:** it is considered to reduce the risk of myocardial infarction and cardiac arrhythmias, precisely because linseed oil supports the health of the entire cardiovascular system.
- **Reduces the level of cholesterol:** this happens because the blood pressure is regulated and the pulse is also regulated.
- Reduces the symptoms of menopause[3].
- **Helps maintain a normal weight:** because linseed oil acts as a natural laxative, it helps the body get rid of toxins and stimulates the digestive system.
- **Can reduce inflammation:** this benefit has not been reported in all people[4].

It is beneficial for the skin: vitamin B in the composition of linseed oil makes the skin increase its elasticity and acts on fine lines and not very deep wrinkles. It is considered that linseed oil has a beneficial effect on acne, eczema and inflammation that can appear on the skin[5].

It is beneficial for the hair: the dermatologist can prescribe linseed oil to treat eczema on the scalp, because it has an anti-inflammatory effect and has the ability to regenerate cells. In addition, linseed oil can also be recommended because it hydrates the hair very well, increases its beauty and shine. It is beneficial for nails: linseed oil nourishes nails and gives them resistance.The best way to use linseed oil is in salads.

Linseed oil is not suitable for cooking, because any source of heat causes it to lose its properties.

There are some aspects that must be taken into account:

- It is not recommended to consume linseed oil if you are under treatment, or if you take food supplements, because it can prevent the absorption of active substances in the body[1].
- The consumption of linseed oil is not indicated if you are undergoing treatment for blood thinning, because there is a risk of bleeding.
- The consumption of linseed oil is not indicated even in the case of people suffering from diabetes.
- It is not indicated to use linseed oil at least 2 weeks before a surgical intervention, because it can increase the risk of hemorrhage during the operation[2].

Also, it should be remembered that in case of excess of linseed oil, unpleasant symptoms may appear such as: bloating, intestinal gas, diarrhea[5-10].

It is not recommended to consume linseed oil in the case of people undergoing treatment with anticoagulant drugs; treatment to reduce blood sugar; treatment with immunosuppressants.

MATERIAL AND METHODS

Linseed oil utilized may be a unrefined oil gotten by cold pressed of flax seeds purchased from a local store. The rheological properties of the linseed oil tests were measured employing a Brookfield RVDV III Ultra Rheometer with round and hollow shaft and ultra moo U L connector. Tests were performed to investigate changes in thickness based on temperature and shear rates. Each explore was performed at slightest twice to guarantee reproducibility.

RESULTS AND DISCUSSION

Figures 1-7 show the exponential fit of dynamic viscosity as a function of temperature at increasing shear rates for linseed oil.

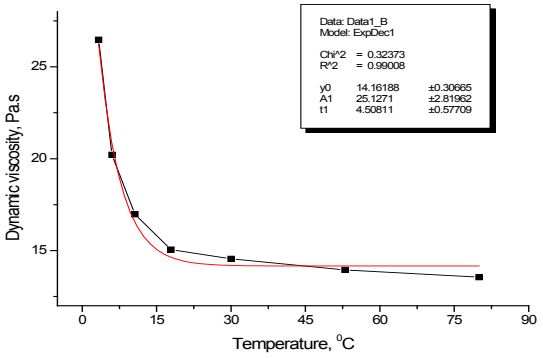

Fig. 1. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 3.3 s^{-1}

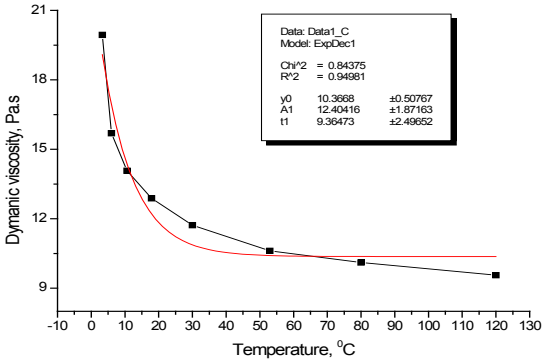

Fig. 2. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 6 s^{-1}

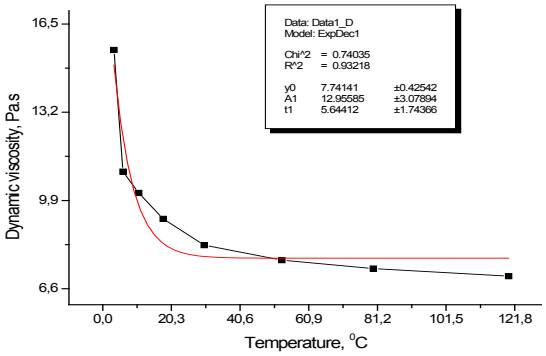

Fig. 3. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 10.6 s^{-1}

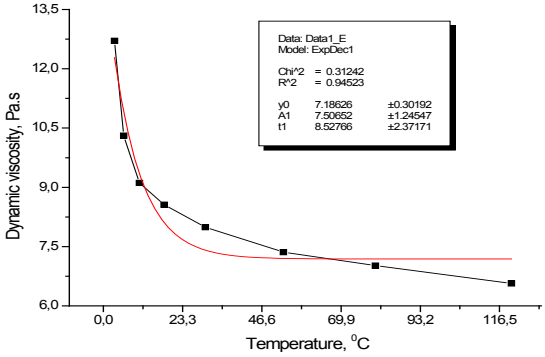

Fig. 4. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 17.87 s^{-1}

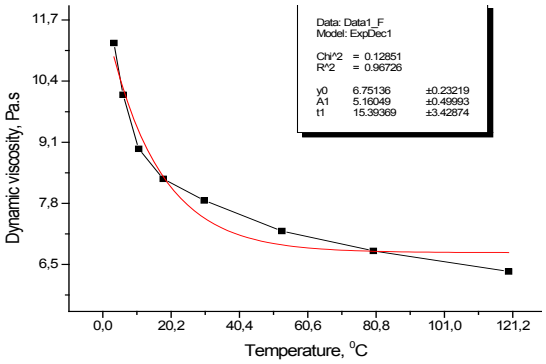

Fig. 5. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 30 s^{-1}

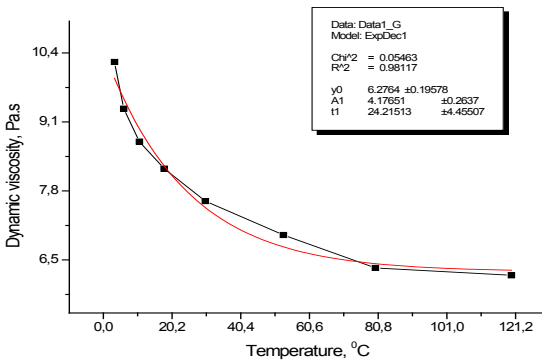

Fig. 6. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 52.95 s^{-1}

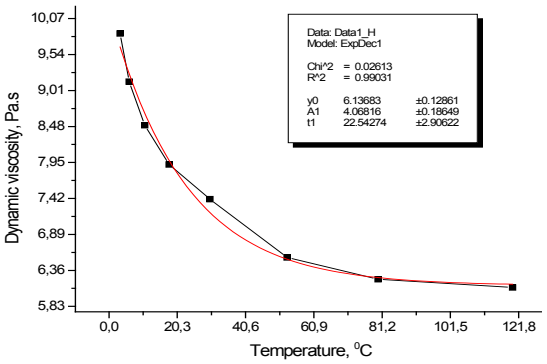

Fig. 7. Exponential fitting of the dynamic viscosity curve as a function of temperature at shear rate 80 s^{-1}

The first-order exponential equation that describes the rheological behavior of linseed oil at various temperatures and shear rates is of the form:

$$\eta = \eta_0 + A_1 \exp(-t/t_1) \quad (1)$$

Where the parameters η_0, A_1 and t_1 can take different values depending on the shear speed to which the linseed oil is subjected.

Table 1 shows the shear speeds and correlation coefficients obtained by linear fitting of the obtained curves.

Table 1: Correlation coefficients of the curves[1-7]

Shear rate, s^{-1}	Correlation coefficients
3.3	0.9900
6	0.9498
10.6	0.9322
17.87	0.9452
30	0.9673
52.95	0.9812
80	0.9903

It can be seen from the table that by applying the first-order exponential equation to the experimental curves, values of the correlation coefficients close to unity are obtained at low shear rates and at high shear rates. At shear speeds 6, 10.6, 17.87 and 30 s^{-1}, the exponential equation cannot be applied because the correlation coefficients have values between 0.9452 and 0.9673[11-17].

The study of the rheological properties of linseed oil is vital for optimizing its application in various fields. Understanding these properties can lead to better formulations and improved performance in its diverse uses. If you need more specific information on certain applications or research studies related to the rheology of linseed oil, feel free to ask.

CONCLUSION

The purpose of this article was to find a relationship of the dynamic viscosity dependence on temperature for linseed oil. Through exponential fitting, we found a relationship that can be applied to

linseed oil at all shear speeds because the obtained correlation coefficients have values close to unity.

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Conflict of interest

The author declare that we have no conflict of interest.

REFERENCE

1. Cherry J.P., *J. of the American Oil Chemists' Society*., **1983**, *60*(2Part2), 360-367.
2 Stanciu I., *Journal of Science and Arts*., **2019**, *3*(48), 703-708.
3. Rashid U.; Anwar F., & Knothe G.,*Fuel Processing Technol.,* **2009**, *90*(9), 1157-1163.
4. Stanciu I., *Journal of Science and Arts*., **2019**, *4*(49), 938-988.
5. Saxena D.K.; Sharma S. K., & Sambi S. S., *ARPN Journal of Engineering and Applied Sciences*., **2011**, *6*(1), 84-89.
6. Stanciu I., *Journal of Science and Arts*., **2011**, *1*, 55-58.
7. Stanciu I., *Journal of Science and Arts*., **2018**, *18*(2), 453-458.
8. Sheibani A.; Ghotbaddini-Bahraman, N. A. S. E. R., & Sadeghi, F. A. T. E. M. E. H., Orient. J. Chem., **2014**, *30*(3), 1205-1209.
9. Omar M. N.; Nor N. N. M., & Idris, N. A., *Orient. J. Chem*., **2009**, *25*(4), 825.
10. Audu S. S.; Aremu M. O., & Lajide, L., *Orient. J. Chem*., **2013,** *29*(3), 979-989.
11. Stanciu I., Some methods for determining the viscosity index of hydraulic oil., *Indian Journal of Science & Technology*., **2023**, *16*(4), 254-258.
12. Stanciu I., Rheological behavior of corn oil at different viscosity and shear rate., *Orient. J. Chem.,* **2023**, *39*(2), 335-339.
13. Stanciu I., Rheological characteristics of corn oil used in biodegradable lubricant., *Orient. J. Chem*., **2023**, *39*(3), 592-595.
14. Stanciu I., Effect of temperature on rheology of corn (Zea mays) oil., *Orient. J. Chem.,* **2023**, *39*(4), 1068-1070.
15. Stanciu I., *Orient. J. Chem.,* **2021**, *37*(1), 247-249.
16. Stanciu I., *Orient. J. Chem.,* **2021**, *37*(2), 440-443.
17. Stanciu I., *Orient. J. Chem.,* **2021**, *37*(4), 864-867.